I am a graduating senior—circle one: Yes / No

READ THE FOLLOWING GENERAL EXAMINATION RULES:

1) Do not put your completed work anywhere that it can be seen. If any part of your work can be seen by others it will be confiscated and you will not be permitted to rework those problems. Place any pages of your work face down on your desk under your existing work, not on the floor next to you where it is visible.
2) Please remove your hat. If it is part of your head, turn it around backwards.
3) If your work is not legible, or if I cannot follow your logic at a glance, it will receive no credit. This paper must be written to acceptable engineering standards for credit. Please take this seriously as it will affect your grade.
4) You may work on the front or back of this paper. Just note if work is on the back.
5) You can use your own paper or paper supplied at the front of the room.
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I have read and understand all of the above instructions: __________ (Initials)

Ethical Standards:

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System.

"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam."

________________________
Signature of student

Please do not open this exam until you are told to do so.
Problem 1) Charitable giving: If you give a qualified charitable organization some amount of money, the government allows you to reduce that year's taxable income by that amount, up to ½ of your income. If your income this year is $100,000, that will put you in the 31% tax bracket, and if you give a charity $10,000 you can reduce your taxable income by that amount.

On the other hand, a Lifetime Charitable Gift Annuity (LCGA) is a different way of giving. Rather than giving them $10,000 as a gift, you purchase a LCGA from them. Depending on your age, they will then yearly pay you a very high rate of interest on the amount, often as high as 9% per year or more, for as long as you live. With banks currently paying around 2%, that's not bad. You still get the immediate $10,000 reduction in taxable income and the tax savings that goes with it. What's more, 2/3 of the yearly payments you receive from the charity are also tax free, being considered a tax-free return of principal rather than income. The other 1/3 of your yearly check is still taxable.

I am personally in the 38% tax bracket, and have decided to either give $10,000, or to buy a $10,000 LCGA. Including tax implications, what is my NPV for giving the money, vs. purchasing the LCGA? I am 70 years old and you can use the information on the attached sheets as accurate, including interest rates the charity will pay, and life expectancies. The LCGA will give me a payment at the end of each year, including a last payment in the year of my unfortunate demise in a high speed motorcycle collision with a train, as predicted by the Period Life Table. Any remaining money then goes to the charity. My MARR is 4%.
Charity (Age = 70)

$10,000 \times 0.38 = \$3,800 \text{ tax savings}

\[ NPV = PVB - PVC = \$3,800 - 10,000 = -\$6,200 \]

Check is for $10,000 \times 0.051 = 510$

\[ A = \left(\frac{10,000 \times 0.051}{0.38}\right)^{\frac{2}{3}} + (10,000 \times 0.051)(1 - 0.38) = \$340 + 105.40 = \$445.40/\text{year} \]

\[ NPV = -10,000 + \$445.40 \left[ \frac{1}{10.5631} \right] + 3,800 \]

\[ = -10,000 + 4704.80 + 3,800 \]

\[ = -\$1,495.20 \]
Problem 2) Determine the Net Present Value for the following project. It is a 22 year project which requires an initial investment of $3,000k. Additional investments of $500 k will be required every 5th year in the future, i.e. at years 5, 10, etc. Your MARR is 6%. The project will return no profit for the first 11 years, but will show a profit of $1,200k per year each year, starting at the end of the 12th year and continuing until the close of the project.
\[
\text{NPVB} = 1200 \left[ \frac{1}{P/A, 0.06, 11} \right] \left[ \frac{1}{P/F, 0.06, 11} \right] = 4985.78
\]
\[
\text{NPVC} = -3000 - 500 \left[ \frac{1}{A/F, 0.06, 5} \right] \left[ \frac{1}{P/A, 0.06, 20} \right] = 4017.38
\]
\[
\text{NPV} = 4985.78 - 4017.38 = \$968.40
\]
Problem 3) Determine the internal rate of return on a 10 year project where the initial investment is $200k. The project is projected to generate no income through the 3rd year, but will make $42.7k per year for the last 7 years. Hint: This is a trial and error problem.
IRR

\[ A = 42.7 \]

\[ 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad m = 10 \]

\[ \$200 \]

\[ -200 + 42.7 \left[ \frac{P}{A, i, 7} \right] \] \[ + 42.7 \left[ \frac{P}{F, i, 3} \right] = 0 \]

**NPV**

\[ \begin{align*}
0 &= -200 + 42.7 \left[ \frac{P}{A, 2\%, 7} \right] \left[ \frac{P}{F, 2\%, 3} \right] \\
0 &= -200 + 42.7 \left[ 6.4720 \right] \left[ 0.9423 \right] = 60.41 \\
0 &= -200 + 42.7 \left[ 6.0021 \right] \left[ 0.8890 \right] = 27.84 \\
0 &= -200 + 42.7 \left[ 5.5824 \right] \left[ 0.8396 \right] = 0.13 \\
0 &= -200 + 42.7 \left[ 5.2064 \right] \left[ 0.7938 \right] = -23.53
\end{align*} \]

**IRR = 6%**
I am a graduating senior—circle one: Yes—No

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________________________
Signature of student

Please do not open this exam until you are told to do so.
Problem 1) A 12 year project under consideration is projected to generate no income through the 5th year, but will make $84.76k per year for the last 7 years. Determine the internal rate of return on the project if the initial investment is $300k. Hint: This is a trial and error problem.
A = 84.76

\[
\$300 \times \left[ \frac{\$84.76}{5} \right]_{2\%} = \$196.85, \quad \text{NPV}
\]

\[
\left[ 6.4720 \right]_{2\%} \times \left[ 0.9057 \right] = \$196.85 \times
\]

\[
\left[ 6.0021 \right]_{4\%} \times \left[ 0.8219 \right] = \$118.14 \times
\]

\[
\left[ 5.5824 \right]_{6\%} \times \left[ 0.7473 \right] = \$53.57 \times
\]

\[
\left[ 5.2064 \right]_{8\%} \times \left[ 0.6806 \right] = 0.34 \text{ OK}
\]

\[
\left[ 4.8684 \right]_{10\%} \times \left[ 0.6209 \right] = -43.78 \times
\]

\[
\left[ 4.8684 \right]_{12\%} = -80.51 \times
\]

IRR = 8\%
Problem 2) Charitable giving: If you give a qualified charitable organization some amount of money, the government allows you to reduce that year’s taxable income by that amount, up to 2/3 of your income. If your income this year is $100,000, that will put you in the 31% tax bracket, and if you give a charity $10,000 you can reduce your taxable income by that amount.

On the other hand, a Lifetime Charitable Gift Annuity (LCGA) is a different way of giving. Rather than giving them $10,000 as a gift, you purchase a LCGA from them. Depending on your age, they will then yearly pay you a very high rate of interest on the amount, often as high as 9% per year or more, for as long as you live. With banks currently paying around 2%, that’s not bad. You still get the immediate $10,000 reduction in taxable income and the tax savings that goes with it. What’s more, 2/3 of the yearly payments you receive from the charity are also tax free, being considered a tax-free return of principal rather than income. The other 1/3 of your yearly check is still taxable.

I am 80 years old and you can use the information on the attached sheets as accurate, including interest rates the charity will pay, and life expectancies. I am personally in the 28% tax bracket, and have decided to either give $30,000, or to buy a $30,000 LCGA. My MARR is 2%. Including tax implications, what is my NPV for giving the money, vs. purchasing the LCGA? The LCGA will give me a payment at the end of each year, including a last payment in the year of my unfortunate demise in a high speed motorcycle collision with a train, as predicted by the Period Life Table. Any remaining money then goes to the charity.
Charity (Age = 80)

\[ \$30,000 \times 0.28 = \$8400 \text{ tax savings} \]

\[ \text{Gift} \]

\[ \text{NPV} = \text{PVB} - \text{PVC} = \$8400 - 30,000 \]

\[ \text{NPV} = -\$21,600 \]

LCGA

\[ m = 8 \]

\[ \text{Check to me} = \$30,000 \times 0.068 = 2040/\text{yr} \]

\[ \text{Tax-free} \]

\[ \text{NPV} = -30,000 + 2040 \left( \frac{7.3255}{1.02^8} \right) + 8400 \]

\[ + 2040 \left( \frac{1}{1.02} \right) \left( \frac{7.3255}{1.02} \right) (1 - 0.28) \]

\[ \text{Tangible} \]

\[ \text{MARR} \]

\[ = -30,000 + 9962.68 + 8400 + 3586.56 \]

\[ = -8050.76 \]
Problem 3) You are considering a 22 year project which requires an initial investment of $6,000k. The project will return no profit for the first 11 years, but will show a profit of $2,400k per year each year, starting at the end of the 12th year and continuing until the close of the project. Additional investments of $1,000k will be required every 5th year in the future, i.e. at years 5, 10, etc. Your MARR is 4%. Determine the Net Present Value for the project.

\[ \text{MARR} = 4\% \]

\[ A = \text{2,400k} \]

\[ \text{NPV} = \frac{-6,000k - 1,000k \left[ \frac{1}{P/F, 4\%, 11} \right] - 1,000k \left[ \frac{1}{P/F, 4\%, 10} \right] - 1,000k \left[ \frac{1}{P/F, 4\%, 15} \right] - 1,000k \left[ \frac{1}{P/F, 4\%, 20} \right]}{1.0456} \]

\[ + \ 0.1100k \left[ \frac{1}{P/A, 4\%, 11} \right] \left[ \frac{1}{P/F, 4\%, 11} \right] = 0 \]

\[ \frac{1}{0.7605} \]

\[ \frac{1}{0.6496} \]

\[ \text{NPV} = \$5148.77k \]